

# PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44bis)

Applicant's or agent's file reference 069225.0153	<b>FOR FURTHER ACTION</b>		See item 4 below
International application No. PCT/US2004/010152	International filing date ( <i>day/month/year</i> ) 31 March 2004 (31.03.2004)	Priority date ( <i>day/month/year</i> ) 31 March 2003 (31.03.2003) ]	
International Patent Classification (IPC) or national classification and IPC 7 G01B 9/02			
Applicant THE GENERAL HOSPITAL CORPORATION			

1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 *bis*.1(a).
2. This REPORT consists of a total of 4 sheets, including this cover sheet.  
  
In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.

3. This report contains indications relating to the following items:

- |   |   |
|---|---|
| <input checked="" type="checkbox"/> Box No. I | Basis of the report   |
| <input type="checkbox"/> Box No. II           | Priority  |
| <input type="checkbox"/> Box No. III          | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability  |
| <input type="checkbox"/> Box No. IV           | Lack of unity of invention  |
| <input checked="" type="checkbox"/> Box No. V | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| <input type="checkbox"/> Box No. VI           | Certain documents cited   |
| <input type="checkbox"/> Box No. VII          | Certain defects in the international application  |
| <input type="checkbox"/> Box No. VIII         | Certain observations on the international application   |

4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44bis.3(c) and 93bis.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44bis .2).

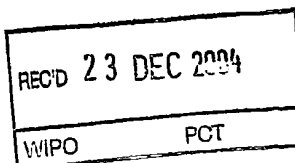
The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland  Facsimile No. +41 22 740 14 35	Date of issuance of this report 01 October 2005 (01.10.2005)
	Authorized officer  <p style="text-align: center;">Masashi Honda</p> Telephone No. +41 22 338 70 10

# PATENT COOPERATION TREATY

From the  
INTERNATIONAL SEARCHING AUTHORITY

To:  
GARY ABELEV  
BAKER BOTTS L.L.P.  
30 ROCKEFELLER PLAZA  
NEW YORK, NY 10112-4498

# PCT



## WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing (day/month/year) <span style="float: right; font-weight: bold;">20 DEC 2004</span>	
Applicant's or agent's file reference  069225.0153	<b>FOR FURTHER ACTION</b> See paragraph 2 below
International application No.  PCT/US04/10152	International filing date (day/month/year)  31 March 2004 (31.03.2004)
Priority date (day/month/year)  31 March 2003 (31.03.2003)	
International Patent Classification (IPC) or both national classification and IPC  IPC(7): G01B 9/02 and US Cl.: 356/479	
Applicant  THE GENERAL HOSPITAL CORPORATION	

1. This opinion contains indications relating to the following items:

- ☒ Box No. I      Basis of the opinion
- ☐ Box No. II      Priority
- ☐ Box No. III      Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV      Lack of unity of invention
- ☒ Box No. V      Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI      Certain documents cited
- ☐ Box No. VII      Certain defects in the international application
- ☐ Box No. VIII      Certain observations on the international application

### 2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/ US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703) 305-3230	Authorized officer Samuel A. Turner <i>[Signature]</i> Telephone No. 703-308-0956
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WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US04/10152

Box No. I Basis of this opinion

1. With regard to the language, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This opinion has been established on the basis of a translation from the original language into the following language \_\_\_\_\_, which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).

2. With regard to any nucleotide and/or amino acid sequence disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

a. type of material

☐ a sequence listing

☐ table(s) related to the sequence listing

b. format of material

☐ in written format

☐ in computer readable form

c. time of filing/furnishing

☐ contained in international application as filed.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
14 October 2004 (14.10.2004)

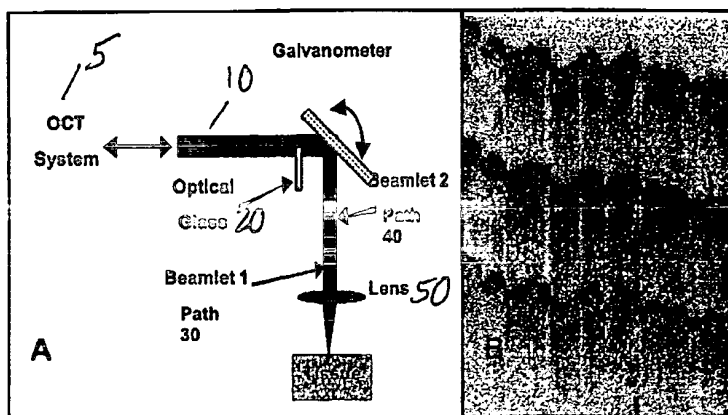
PCT

(10) International Publication Number  
**WO 2004/088361 A3**

- (51) International Patent Classification<sup>7</sup>: **G01B 9/02** (74) Agent: ABELEV, Gary; Dorsey & Whitney L.L.P., 250 Park Avenue, New York, NY 10177 (US).
- (21) International Application Number: PCT/US2004/010152 (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (22) International Filing Date: 31 March 2004 (31.03.2004)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:  
60/459,543 31 March 2003 (31.03.2003) US  
60/476,600 6 June 2003 (06.06.2003) US  
60/514,769 27 October 2003 (27.10.2003) US
- (71) Applicant (for all designated States except US): **THE GENERAL HOSPITAL CORPORATION** [US/US]; 55 Fruit Street, Boston, MA 02114 (US).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): **TEARNEY, Guillermo, J.** [US/US]; 118 Kinnaird St., #3, Cambridge, MA 02139 (US). **IFTIMIA, Nicusor. BOUMA, Brett, E.** [US/US]; 12 Monmouth St., Quincy, MA 02171 (US).
- Published:  
— with international search report

[Continued on next page]

(54) Title: **SPECKLE REDUCTION IN OPTICAL COHERENCE TOMOGRAPHY BY PATH LENGTH ENCODED ANGULAR COMPOUNDING**



(57) Abstract: Speckle, a factor reducing image quality in optical coherence tomography ("OCT"), can limit the ability to identify cellular structures that are important for the diagnosis of a variety of diseases. The present invention allows for an implementation of an angular compounding, angular compounding by path length encoding ("ACPE") for reducing speckle in OCT images. By averaging images obtained at different incident angles, with each image encoded by path length, ACPE maintains high-speed image acquisition and implements minimal modifications to OCT probe optics. ACPE images obtained from tissue phantoms and human skin in vivo demonstrate a qualitative improvement over traditional OCT and an increased signal-to-noise ratio ("SNR"). Accordingly, apparatus probe catheter, and method are provided for irradiating a sample. In particular, an interferometer (5) may forward an electromagnetic radiation (10). In addition, a sample arm may receive the electromagnetic radiation, and can include an arrangement (20) which facilitates a production of at least two radiations (30, 40) from the electromagnetic radiation so as to irradiate the sample. Such arrangement can be configured to delay a first radiation of the at least two radiations with respect to a second radiation of the at least two radiations.

WO 2004/088361 A3



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(88) Date of publication of the international search report:  
7 April 2005

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/10152

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : G01B 9/02

US CL : 356/479

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 356/479, 497

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 01/33820 A1 (HAAG-STREIT AG) 31 May 2001(31.5.2001), see figure 4.	1, 11-13, 21-23, 25, 26
A		2-10, 14-20-, 24



Further documents are listed in the continuation of Box C.



See patent family annex.

Special categories of cited documents:	
"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application, but which is understood the principle or theory underlying the invention
"E" earlier application or patent published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

29 October 2004 (29.10.2004)

Date of mailing of the international search report

20 DEC 2004

Name and mailing address of the ISA/US

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Authorized officer

Samuel A. Turner

Telephone No. 703-308-0956

WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

International application No.  
PCT/US04/10152

Box No. V Reasoned statement under Rule 43 *bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims <u>2-10, 14-20, and 24</u>	YES
	Claims <u>1, 11-13, 21-23, 25, and 26</u>	NO
Inventive step (IS)	Claims <u>2-10, 14-20, and 24</u>	YES
	Claims <u>1, 11-13, 21-23, 25, and 26</u>	NO
Industrial applicability (IA)	Claims <u>1-26</u>	YES
	Claims <u>NONE</u>	NO

2. Citations and explanations:

Claims 1, 11-13, 21-23, 25, and 26 lack novelty under PCT Article 33(2) as being anticipated by Waelti et al(WO 01/38820).

Waelti et al teach an interferometer sample arm that contains an arrangement(120) for providing a delay in at least one of two radiations.

Claims 2-10, 14-20, and 24 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest generating a plurality of images based on the radiations of the sample arm and a reference arm.